DEPARTMENT OF ENERGY

10 CFR Part 430

[EERE-2019-BT-STD-0030]

RIN 1904-AE40

Energy Conservation Program: Energy Conservation Standards for General Service Fluorescent Lamps

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Notice of proposed determination and request for comment.

SUMMARY: The Energy Policy and Conservation Act, as amended ("EPCA"), prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including general service fluorescent lamps ("GSFLs"). EPCA also requires the U.S. Department of Energy ("DOE") to periodically determine whether more-stringent, amended standards would be technologically feasible and economically justified, and would result in significant energy savings. In this notice of proposed determination ("NOPD"), DOE has initially determined that amended energy conservation standards for GSFLs do not need to be amended and requests comment on this proposed determination and the associated analyses and results.

DATES: *Meeting*: DOE will hold a webinar on Monday, July 11, 2022, from 1:00 p.m. to 4:00 p.m. See section VII, "Public Participation," for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

Comments: Written comments and information are requested and will be accepted on or before [**INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***]**.**

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov*, under docket number EERE–2019–BT–STD-0030. Follow the instructions for submitting comments. Alternatively, comments may be submitted by e-mail to: *ApplianceStandardsQuestions*@ee.doe.gov. Include docket number EERE–2019–BT–STD-0030 in the subject line of the message.

No telefacsimiles ("faxes") will be accepted. For detailed instructions on submitting comments and additional information on this process, see section VII of this document.

Although DOE has routinely accepted public comment submissions through a variety of mechanisms, including the Federal eRulemaking Portal, email, postal mail and hand delivery/courier, the Department has found it necessary to make temporary modifications to the comment submission process in light of the ongoing coronavirus 2019 ("COVID-19") pandemic. DOE is currently suspending receipt of public comments via postal mail and hand delivery/courier. If a commenter finds that this change poses an undue hardship, please contact Appliance Standards Program staff at (202) 586-1445 to discuss the need for alternative arrangements. Once the COVID-19 pandemic health emergency is resolved, DOE anticipates resuming all of its regular options for public comment submission, including postal mail and hand delivery/courier.

Docket: The docket, which includes *Federal Register* notices, public meeting attendee lists and transcripts, comments, and other supporting documents/materials, is

available for review at *www.regulations.gov*. All documents in the docket are listed in the *www.regulations.gov* index. However, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure.

The docket web page can be found at *www.regulations.gov/#!docketDetail;D=EERE-2019-BT-STD-0030*. The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section VII, "Public Participation," for further information on how to submit comments through *www.regulations.gov*.

FOR FURTHER INFORMATION CONTACT:

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For further information on how to submit a comment or review other public comments and the docket contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov*.

SUPPLEMENTARY INFORMATION:

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I. Synopsis of the Proposed Determination

Title III, Part B[1] of EPCA,[2] established the Energy Conservation Program for Consumer Products Other Than Automobiles. (42 U.S.C. 6291-6309) These products include GSFLs, the subject of this NOPD.

DOE is issuing this NOPD pursuant to the EPCA requirement that not later than 6 years after issuance of any final rule establishing or amending a standard, DOE must publish either a notification of determination that standards for the product do not need to be amended, or a notice of proposed rulemaking ("NOPR") including new proposed

[1] For editorial reasons, upon codification in the U.S. Code, Part B was redesignated Part A.
[2] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Pub. L. 116-260 (Dec. 27, 2020), which reflect the last statutory amendments that impact Parts A and A-1 of EPCA.

energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m))

For this proposed determination, DOE analyzed GSFLs subject to standards specified in 10 of the Code of Federal Regulations ("CFR") part 430, subpart A, §430.2.

DOE first analyzed the technological feasibility of more energy efficient GSFLs. For those GSFLs for which DOE determined higher standards to be technologically feasible, DOE estimated energy savings that would result from potential energy conservation standards by conducting a national impact analysis ("NIA"). DOE evaluated whether higher standards would be cost effective by conducting life-cycle cost ("LCC") and payback period ("PBP") analyses, and estimated the net present value ("NPV") of the total costs and benefits experienced by consumers.

Based on the results of the analyses, summarized in section V of this document, DOE has tentatively determined that current standards for GSFLs do not need to be amended.

II. Introduction

The following section briefly discusses the statutory authority underlying this proposed determination, as well as some of the historical background relevant to the establishment of standards for GSFLs.

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part B of EPCA established the

Energy Conservation Program for Consumer Products Other Than Automobiles. These products include GSFLs, the subject of this document. (42 U.S.C. 6292(a)(14)) EPCA prescribed energy conservation standards for these products (42 U.S.C. 6295(i)(1)(B)), and directs DOE to conduct future rulemaking to determine whether to amend these standards. (42 U.S.C. 6295(i)(3)-(5))

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) the establishment of Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA specifically include definitions (42 U.S.C. 6291), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of each covered product. (42 U.S.C. 6295(o)(3)(A) and 42 U.S.C. 6295(r)) Manufacturers of covered products must use the prescribed DOE test procedure as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA and when making representations to the public regarding the energy use or efficiency of those products. (42 U.S.C. 6293(c) and 42 U.S.C. 6295(s)) Similarly, DOE must use these test procedures to determine whether the products comply with standards adopted pursuant to EPCA. (42 U.S.C. 6295(s)) The DOE test procedures for GSFLs appear at 10 CFR part 430, subpart B, appendix R.

Federal energy conservation requirements generally supersede State laws or regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6297(a)-(c)) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions set forth under EPCA. (*See* 42 U.S.C. 6297(d))

Pursuant to the amendments contained in the Energy Independence and Security Act of 2007 ("EISA 2007"), Pub. L. 110-140, any final rule for new or amended energy conservation standards promulgated after July 1, 2010, is required to address standby mode and off mode energy use. (42 U.S.C. 6295(gg)(3)) Specifically, when DOE adopts a standard for a covered product after that date, it must, if justified by the criteria for adoption of standards under EPCA (42 U.S.C. 6295(o)), incorporate standby mode and off mode energy use into a single standard, or, if that is not feasible, adopt a separate standard for such energy use for that product. (42 U.S.C. 6295(gg)(3)(A)-(B)) DOE has determined that standby mode and off mode do not apply to GSFLs and that their energy use is accounted for entirely in the active mode. Therefore, DOE is not addressing standby and off modes, and will only address active mode in this proposed determination. In this analysis DOE considers only active mode in its determination of whether energy conservation standards need to be amended.

DOE must periodically review its already established energy conservation standards for a covered product no later than 6 years from the issuance of a final rule establishing or amending a standard for a covered product. (42 U.S.C. 6295(m)) This 6-year look-back provision requires that DOE publish either a determination that standards do not need to be amended or a NOPR, including new proposed standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(1)) EPCA further provides that, not

later than 3 years after the issuance of a final determination not to amend standards, DOE must publish either a notification of determination that standards for the product do not need to be amended, or a NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6295(m)(3)(B)) DOE must make the analysis on which a determination is based publicly available and provide an opportunity for written comment. (42 U.S.C. 6295(m)(2))

A determination that amended standards are not needed must be based on consideration of whether amended standards will result in significant conservation of energy, are technologically feasible, and are cost effective. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)) Additionally, any new or amended energy conservation standard prescribed by the Secretary for any type (or class) of covered product shall be designed to achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified. (42 U.S.C. 6295(o)(2)(A)) Among the factors DOE considers in evaluating whether a proposed standard level is economically justified includes whether the proposed standard at that level is cost effective, as defined under 42 U.S.C. 6295(o)(2)(B)(i)(II). Under 42 U.S.C. 6295(o)(2)(B)(i)(II), an evaluation of cost effectiveness requires DOE to consider savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses for the covered products that are likely to result from the standard. (42 U.S.C. 6295(n)(2) and 42 U.S.C. 6295(o)(2)(B)(i)(II)) DOE is publishing this NOPD in satisfaction of the 6-year review requirement in EPCA.

B. Background

1. Current Standards

In a final rule published on January 26, 2015, DOE prescribed the current energy conservation standards for GSFLs. 80 FR 4042 ("January 2015 final rule"). These standards are set forth in DOE's regulations at 10 CFR 430.32(n) and repeated in Table II.1.

Table II.1 Federal Energy Conservation Standards for GSFLs

Lamp Type	Correlated Color Temperature	Minimum Average Lamp Efficacy *Lumens per watt ("lm/W")*
Four-Foot Medium Bipin ("MBP")	≤ 4,500 Kelvin ("K")	92.4
	> 4,500 K and ≤ 7,000 K	88.7
Two-Foot U-Shaped	≤ 4,500 K	85.0
	> 4,500 K and ≤ 7,000 K	83.3
Eight-Foot Single Pin ("SP") Slimline	≤ 4,500 K	97.0
	> 4,500 K and ≤ 7,000 K	93.0
Eight-Foot Recessed Double Contact ("RDC") High Output	≤ 4,500 K	92.0
	> 4,500 K and ≤ 7,000 K	88.0
Four-Foot Miniature Bipin Standard Output	≤ 4,500 K	95.0
	> 4,500 K and ≤ 7,000 K	89.3
Four-Foot Miniature Bipin High Output	≤ 4,500 K	82.7
	> 4,500 K and ≤ 7,000 K	76.9

2. History of Standards Rulemakings for GSFLs

Amendments to EPCA in the Energy Policy Act of 1992 ("EPAct 1992"; Pub. L. 102-486), established energy conservation standards for certain classes of GSFLs and incandescent reflector lamps ("IRLs"), and authorized DOE to conduct two rulemaking cycles to determine whether these standards should be amended. (42 U.S.C. 6295(i)(1) and (3)-(4)) EPCA also authorized DOE to adopt standards for additional GSFLs, if such standards were warranted. (42 U.S.C. 6295(i)(5)). DOE completed the first of these

rulemaking cycles in a final rule published on July 14, 2009, that adopted amended performance standards for GSFLs and IRLs manufactured on or after July 14, 2012. 74 FR 34080. That rule adopted standards for additional GSFLs, amended the definition of "colored fluorescent lamp" and "rated wattage," and also adopted test procedures applicable to the newly covered GSFLs. *Id*. DOE completed a second rulemaking cycle to amend the standards for GSFLs and IRLs by publishing a final rule on January 26, 2015. 80 FR 4042. In this rule DOE amended standards for GSFLs; and concluded that amending standards for IRLs would not be economically justified. *Id*. The current energy conservation standards for GSFLs are located in 10 CFR 430.32(n). The currently applicable DOE test procedures appear at 10 CFR part 430, subpart B, appendix R.

In support of the present review of the GSFL energy conservation standards, DOE published a request for information ("RFI"), which identified various issues on which DOE sought comment to inform its determination of whether amended standards for GSFLs and IRLs are warranted. 85 FR 25326 ("May 2020 RFI").

Subsequently, on May 9, 2022, DOE published a final rule expanding the definition of general service lamp ("GSL") to include IRLs. 87 FR 27461 May 2022 Final Rule. On that same day, DOE also published a final rule implementing a statutory backstop requirement applicable to GSLs which prohibits the sale of any GSL that is less than 45 lm/W. 87 FR 27439. Because IRLs, a newly covered GSL, cannot meet the 45 lm/W backstop requirement, DOE is no longer evaluating amended standards for IRLs and is only considering GSFLs in this NOPD.

DOE received comments in response to the May 2020 RFI from the interested parties listed in Table II.2.

Table II.2 Written Comments Received in Response to the May 2020 RFI

Commenter(s)	Reference in this NOPD	Commenter Type
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, Consumer Federation of America, National Consumer Law Center, Natural Resources Defense Council, Northeast Energy Efficiency Partnerships, Northwest Energy Efficiency Alliance	ASAP et al	Efficiency Organizations
Attorneys General	Attorneys General	State Official/Agency
California Energy Commission	CEC	State Official/Agency
Pacific Gas and Electric Company, San Diego Gas & Electric Company, Southern California Edison	CA IOUs	Utilities
Consumer Federation of America, Environment America, National Consumer Law Center, Natural Resources Defense Council, Sierra Club, U.S. Public Interest Research Group, Earthjustice	CFA et al	Consumer Advocacy Organizations
Institute for Policy Integrity at NYU School of Law	IPI	Think Tank
National Electrical Manufacturers Association	NEMA	Trade Association

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[3]

C. Deviation from Appendix A

In accordance with section 3(a) of 10 CFR part 430 subpart C, appendix A ("appendix A"), DOE notes that it is deviating from the provision in appendix A regarding the comment period for a notice of proposed rulemaking. Section 6(f)(2) of appendix A specifies that the length of the public comment period for a NOPR will not be less than 75 days. For this proposed determination, DOE has opted to instead provide a

[3] The parenthetical reference provides a reference for information located in the docket. (Docket No. EERE-2019-BT-STD-0030, which is maintained at *www.regulations.gov/).* The references are arranged as follows: (commenter name, comment docket ID number at page of that document).

60-day comment period. As stated previously, DOE requested comment in the May 2020 RFI on the technical and economic analyses that would be used to determine whether a more stringent standard would result in significant conservation of energy and is technologically feasible and economically justified. DOE has determined that a 60-day comment period, in conjunction with the prior May 2020 RFI, provides sufficient time for interested parties to review the proposed rule and develop comments.

III. General Discussion

DOE developed this proposed determination after considering comments, data, and information from interested parties that represent a variety of interests. This notice addresses issues raised by these commenters.

A. Product Classes and Scope of Coverage

When evaluating and establishing energy conservation standards, DOE divides covered products into product classes by the type of energy used or by capacity or other performance-related features that justify differing standards. In making a determination whether a performance-related feature justifies a different standard, DOE must consider such factors as the utility of the feature to the consumer and other factors DOE determines are appropriate. (42 U.S.C. 6295(q)) The product classes for this proposed determination are discussed in further detail in section IV.B.4 of this document. This proposed determination covers GSFLs defined as any fluorescent lamp which can be used to satisfy the majority of fluorescent lighting applications, but does not include any lamp designed and marketed for the following nongeneral application: (1) Fluorescent lamps designed to promote plant growth; (2) Fluorescent lamps specifically designed for cold temperature applications; (3) Colored fluorescent lamps; (4) Impact-resistant fluorescent

lamps; (5) Reflectorized or aperture lamps; (6) Fluorescent lamps designed for use in reprographic equipment; (7) Lamps primarily designed to produce radiation in the ultra-violet region of the spectrum; and (8) Lamps with a Color Rendering Index of 87 or greater. 10 CFR 430.2. The scope of coverage is discussed in further detail in section IV.B.1 of this document.

B. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6293) Manufacturers of covered products must use these test procedures to certify to DOE that their product complies with energy conservation standards and to quantify the efficiency of their product. (42 U.S.C. 6295(s) and 42 U.S.C. 6293(c)). DOE's current energy conservation standards for GSFLs are expressed in terms of lumens per watt ("lm/W"). (*See* 10 CFR part 430, subpart B, appendix R)

On July 6, 2009, DOE published a final rule that updated citations to industry standards and made several other modifications to the GSFL test procedure. 74 FR 31829. DOE further amended the test procedures to update references to industry standards for GSFLs in a final rule published on January 27, 2012. 77 FR 4203. On August 8, 2017, DOE published a RFI seeking comments on the current test procedures for GSFLs, IRLs, and general service incandescent lamps ("GSILs"). 82 FR 37031. On June 3, 2021, DOE published a NOPR proposing amendments to DOE's GSFL, IRL and GSIL test procedures. 86 FR 29888. ("June 2021 NOPR") With regards to GSFLs, in the June 2021 NOPR, DOE proposed to update to the latest versions of the referenced industry test standards and provide cites to specific sections of these standards; clarify definitions, test conditions and methods, and measurement procedures; clarify test frequency and inclusion of cathode power in measurements; allow manufacturers to make

voluntary (optional) representations of GSFLs at high frequency settings; revise the sampling requirements; and align sampling and certification requirements with proposed test procedure terminology and with the Federal Trade Commission's labeling program. 86 FR 29888. DOE continues to review comments received in response to the June 2021 NOPR.

The current test procedures for GSFLs are codified in appendix R to subpart B of 10 CFR part 430.

C. Technological Feasibility

1. General

In evaluating potential amendments to energy conservation standards, DOE conducts a screening analysis based on information gathered on all current technology options and prototype designs that could improve the efficiency of the products or equipment that are the subject of the determination. As the first step in such an analysis, DOE develops a list of technology options for consideration in consultation with manufacturers, design engineers, and other interested parties. DOE then determines which of those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially available products or in working prototypes to be technologically feasible. Sections 6(b)(3)(i) and 7(b)(1) of appendix A.

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) practicability to manufacture, install, and service; (2) adverse impacts on product utility or availability; (3) adverse impacts on health or safety; and (4) unique-pathway proprietary technologies. Sections 6(b)(3)(ii)-(v) and 7(b)(2)-(5) of appendix A. Section IV.B.3 of this document discusses the results of the screening

analysis for GSFLs, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this proposed determination. For further details on the screening analysis for this proposed determination, see chapter 4 of the NOPD technical support document ("TSD").

2. Maximum Technologically Feasible Levels

As when DOE proposes to adopt an amended standard for a type or class of covered GSFLs, in this analysis it must determine the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such a product. (42 U.S.C. 6295(p)(1)) Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible ("max-tech") improvements in energy efficiency for GSFLs, using the design parameters for the most efficient products available on the market or in working prototypes. The max-tech levels that DOE determined for this analysis are described in section IV.C of this proposed determination and in chapter 5 of the NOPD TSD.

D. Energy Savings

1. Determination of Savings

For each efficiency level ("EL") evaluated, DOE projected energy savings from application of the EL to the GSFLs purchased in the 30-year period that begins in the assumed year of compliance with the potential standards (2026–2055). The savings are measured over the entire lifetime of the GSFLs purchased in the previous 30-year period. In order to account for wider market dynamics, DOE also modeled the purchases and energy consumption of tubular LEDs ("TLEDs") over the same period that would compete for GSFL demand. DOE quantified the energy savings attributable to each EL as the difference in energy consumption of both GSFLs and TLEDs between each

standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for a product would likely evolve in the absence of amended energy conservation standards. DOE used its NIA spreadsheet model[4] to estimate national energy savings ("NES") from potential amended or new standards for GSFLs. The NIA spreadsheet model (described in section IV.G of this document) calculates energy savings in terms of site energy, which is the energy directly consumed by products at the locations where they are used. For electricity, DOE reports NES in terms of primary energy savings, which is the savings in the energy that is used to generate and transmit the site electricity. DOE also calculates NES in terms of full-fuel-cycle ("FFC") energy savings. The FFC metric includes the energy consumed in extracting, processing, and transporting primary fuels (*i.e.*, coal, natural gas, petroleum fuels), and thus presents a more complete picture of the impacts of energy conservation standards.[5] DOE's approach is based on the calculation of an FFC multiplier for each of the energy types used by covered products or equipment. For more information on FFC energy savings, see section IV.G of this document.

2. Significance of Savings

In determining whether amended standards are needed, DOE must consider whether such standards will result in significant conservation of energy. (42 U.S.C. 6295(m)(1)(A)) The significance of energy savings offered by a new or amended energy conservation standard cannot be determined without knowledge of the specific circumstances surrounding a given rulemaking. For example, the United States has now rejoined the Paris Agreement on February 19, 2021. As part of that agreement, the United States has committed to reducing GHG emissions in order to limit the rise in

[4] A model coded in the Python programming language to estimate lamp purchases, energy consumption, and national energy savings.
[5] The FFC metric is discussed in DOE's statement of policy and notice of policy amendment. 76 FR 51282 (Aug. 18, 2011), as amended at 77 FR 49701 (Aug. 17, 2012).

mean global temperature.[6] As such, energy savings that reduce GHG emission have taken on greater importance. Additionally, some covered products and equipment have most of their energy consumption occur during periods of peak energy demand. The impacts of these products on the energy infrastructure can be more pronounced than products with relatively constant demand. In evaluating the significance of energy savings, DOE considers differences in primary energy and FFC effects for different covered products and equipment when determining whether energy savings are significant. Primary energy and FFC effects include the energy consumed in electricity production (depending on load shape), in distribution and transmission, and in extracting, processing, and transporting primary fuels (i.e., coal, natural gas, petroleum fuels), and thus present a more complete picture of the impacts of energy conservation standards. Accordingly, DOE evaluates the significance of energy savings on a case-by-case basis.

E. Cost Effectiveness

Under EPCA's six-year-lookback review provision for existing energy conservation standards at 42 U.S.C. 6295(m)(1), cost-effectiveness of potential amended standards is a relevant consideration both where DOE proposes to adopt such standards, as well as where it does not. In considering cost-effectiveness when making a determination of whether amended energy conservation standards do not need to be amended, DOE considers the savings in operating costs throughout the estimated average life of the covered product compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered product that are likely to result from a standard. (42 U.S.C. 6295(m)(1)(A) (*referencing* 42 U.S.C. 6295(n)(2))) Additionally,

[6] *See* Executive Order 14008, 86 FR 7619 (Feb. 1, 2021) ("Tackling the Climate Crisis at Home and Abroad").

any new or amended energy conservation standard prescribed by the Secretary for any type (or class) of covered product shall be designed to achieve the maximum improvement in energy efficiency which the Secretary determines is technologically feasible and economically justified. 42 U.S.C. 6295(o)(2(A) Cost-effectiveness is one of the factors that DOE considers under 42 U.S.C. 6295(o)(2)(B) in determining whether new or amended standards are economically justified. (42 U.S.C. 6295(o)(2)(B)(i)(II)))

In determining cost effectiveness of amending standards for GSFLs, DOE conducted LCC and PBP analyses that estimate the costs and benefits to users from standards. To further inform DOE's consideration of the cost effectiveness of amended standards, DOE considers the NPV of total costs and benefits estimated as part of the NIA. The inputs for determining the NPV of the total costs and benefits experienced by consumers are (1) total annual installed cost, (2) total annual operating costs (energy costs and repair and maintenance costs), and (3) a discount factor to calculate the present value of costs and savings.

F. Further Considerations

Pursuant to EPCA, absent DOE publishing a notification of determination that energy conservation standards for GSFLs do not need to be amended, DOE must issue a NOPR that includes new proposed standards. (42 U.S.C. 6295(m)(1)(B)). The new proposed standards in any such NOPR must be based on the criteria established under 42 U.S.C. 6295(o) and follow the procedures established under 42 U.S.C. 6295(p). (42 U.S.C. 6295(m)(1)(B)). The criteria in 42 U.S.C. 6295(o) require that standards be designed to achieve the maximum improvement in energy efficiency, which the Secretary determines is technologically feasible and economically justified. (42 U.S.C.

6295(o)(2)(A)). In deciding whether a proposed standard is economically justified, DOE must determine whether the benefits of the standard exceed its burdens. (42 U.S.C. 6295(o)(2)(B)(i)). DOE must make this determination after receiving comments on the proposed standard, and by considering, to the greatest extent practicable, the following seven statutory factors:

(1) The economic impact of the standard on manufacturers and consumers of the products subject to the standard;

(2) The savings in operating costs throughout the estimated average life of the covered products in the type (or class) compared to any increase in the price, initial charges for, or maintenance expenses of the covered products that are likely to result from the standard;

(3) The total projected amount of energy (or as applicable, water) savings likely to result directly from the standard;

(4) Any lessening of the utility or the performance of the covered products likely to result from the standard;

(5) The impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the standard;

(6) The need for national energy and water conservation; and

(7) Other factors the Secretary considers relevant.

(42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII))

IV. Methodology and Discussion of Related Comments

This section addresses the analyses DOE has performed for this proposed determination with regard to GSFLs. Separate subsections address each component of DOE's analyses. DOE used several analytical tools to estimate the impact of potential energy conservation standards. The first tool is a spreadsheet that calculates the LCC savings and PBP of potential energy conservation standards. The NIA uses a second spreadsheet set that provides shipments projections, and calculates NES and net present value of total consumer costs and savings expected to result from potential energy conservation standards. These spreadsheet tools are available on the website: *www.regulations.gov/docket?D=EERE-2019-BT-STD-0030.*

A. Overall

DOE received several comments from stakeholders in response to the May 2020 RFI regarding whether DOE should amend standards for GSFLs. NEMA stated that sales of GSFLs have been in a decline which is expected to continue as light-emitting diode ("LED") replacement products (including integrated LED fixtures and LED replacement lamps) continue to replace GSFLs through naturally occurring market adoption without regulation. NEMA noted that based on the current rate of market decline, there is very limited, meaningful energy savings that can be economically justified through revised energy conservation standards for GSFLs. (NEMA, No. 6 at p. 2)

NEMA also stated that slightly increasing the efficacy of fluorescent lamps will not achieve the desired energy savings DOE seeks and will only make lighted areas brighter. NEMA notes that because new construction and renovations are shifting to cost-competitive LED lighting, DOE's calculations in the previous rulemaking that show brighter fluorescent lamps will allow for fewer lamps, fixtures, and ballasts, are no longer realistic. As a result, NEMA notes that fluorescent lamps would not be used in fewer numbers and will still be driven at the rated wattage of the ballasts in existing fixtures, using the same amount of energy. (NEMA, No. 6 at p. 2)

CEC agreed with DOE's findings in the May 2020 RFI that indicated that GSFLs on the market are more energy efficient than current federal standards. CEC noted that setting higher efficiency levels is cost effective and can be achieved using either fluorescent or LED lighting sources. Additionally, CEC pointed out that manufacturing costs and retail prices of TLED lamps are dropping while their market share is increasing and that this trend is expected to continue. CEC determined that more stringent standards will result in significant conservation of energy, are technologically feasible, and are cost effective. CEC asserted that DOE should increase the minimum energy efficiency of GSFLs and consider the technology-neutral utility of replacement lamps by including TLED lamps as a feasible replacement option in its cost analysis. (CEC, No. 9 at p. 3)

ASAP et al and CA IOUs noted that new GSFLs on the market that are currently certified in DOE's compliance certification database are more energy efficient than current federal standards and asserted that DOE should conduct a full analysis to determine whether standards for GSFLs should be amended as the market for GSFLs has changed substantially since the last rulemaking. (ASAP et al, No. 5 at p. 2; CA IOUs, No. 8 at p. 2) ASAP et al added that the new GSFL standards that required compliance in

2018 eliminated many lamp options and forced manufacturers to overhaul their product offerings. As a result, TLEDs have seen an increase in market supply, at a reduced price. (ASAP et al, No. 5 at p. 2) ASAP et al added that raising the existing standards for GSFLs will affect their prices, resulting in a market shift to LED technology. ASAP et al urged DOE to consider the economic and energy saving impacts in its evaluation of higher standards. (ASAP et al, No. 5 at p. 5)

As discussed in section II.A of this document, DOE is required to periodically review its already established energy conservation standards for a covered product no later than 6 years from the issuance of a final rule establishing or amending a standard for a covered product. (42 U.S.C. 6295(m)) This proposed determination represents the mandatory 6-year review of standards for GSFLs. DOE discusses the methodology used to analyze potential standards in the following subsections of this section IV and the results of the analysis in section V of this document. DOE discusses the tentative conclusion regarding amended standards for GSFLs in section V.C of this document.

ASAP et al highlighted two potential market failures that may hinder adoption of energy efficient products. One of the market failures was a lack of information about potential savings causing consumers to focus on lower first costs. The other market failure was a scenario where the entity making the purchase decision, such as the landlord, is not incentivized to purchase slightly more expensive energy efficient products over the lowest cost products. (ASAP et al, No. 5 at pp. 5-6) DOE appreciates the feedback regarding potential market failures in the context of amended energy conservation standards for GSFLs. More efficient substitutes for GSFLs and their associated product prices are discussed in section IV.C of this document. The shipments

analysis and life-cycle cost analysis are discussed in sections IV.F and IV.E of this document.

B. Market and Technology Assessment

DOE develops information in the market and technology assessment that provides an overall picture of the market for the products concerned, including the purpose of the products, the industry structure, manufacturers, market characteristics, and technologies used in the products. This activity includes both quantitative and qualitative assessments, based primarily on publicly available information. The subjects addressed in the market and technology assessment for this proposed determination include (1) a determination of the scope and product classes, (2) manufacturers and industry structure, (3) existing efficiency programs, (4) shipments information, (5) market and industry trends, and (6) technologies or design options that could improve the energy efficiency of GSFLs. The key findings of DOE's market assessment are summarized in the following sections. See chapter 3 of the NOPD TSD for a complete discussion of the market and technology assessment.

1. Scope of Coverage

In this analysis, DOE relied on the definition of fluorescent lamp and general service fluorescent lamp in 10 CFR 430.2. A fluorescent lamp is a low pressure mercury electric-discharge source in which a fluorescing coating transforms some of the ultraviolet energy generated by the mercury discharge into light, including only the following: (1) any 4-foot medium bipin lamp with a rated wattage of 25 or more; (2) any 2-foot U-shaped lamp with a rated wattage of 25 or more; (3) any 8-foot high output ("HO") lamp; (4) any 8-foot slimline lamp with a rated wattage of 49 or more; (5) any 4-foot miniature bipin ("miniBP") standard output ("SO") lamp with a rated wattage of 25

or more; and (6) any 4-foot miniature bipin high output ("HO") lamp with a rated wattage of 44 or more. 10 CFR 430.2. GSFL is defined as any fluorescent lamp which can be used to satisfy the majority of fluorescent lighting applications, but does not include any lamp designed and marketed for the following nongeneral application: (1) fluorescent lamps designed to promote plant growth; (2) fluorescent lamps specifically designed for cold temperature applications; (3) colored fluorescent lamps; (4) impact-resistant fluorescent lamps; (5) reflectorized or aperture lamps; (6) fluorescent lamps designed for use in reprographic equipment; (7) lamps primarily designed to produce radiation in the ultra-violet region of the spectrum; and (8) lamps with a color rendering index ("CRI") of 87 or greater. 10 CFR 430.2. Any product meeting the definition of GSFL is included in DOE's scope of coverage, though all products within the scope of coverage may not be subject to standards.

In response to the May 2020 RFI, DOE received several comments regarding extending coverage to currently exempt lamp types. ASAP et al, CA IOUs and CEC agreed that DOE should expand the GSFL definition to include impact-resistant fluorescent lamps, lamps with a CRI of 87 or greater, and lamps less than 4-foot in length. ASAP et al, CA IOUs and CEC noted that excluding these lamp types from the current definition of GSFL has created a significant loophole in the GSFL standard resulting in increased sales of inefficient T12 lamps mainly comprised of impact-resistant fluorescent lamps and lamps with a CRI of 87 or greater. (ASAP et al, No. 5 at pp. 2-4; CA IOUs, No. 8 at pp. 2-3; CEC, No. 9 at pp. 1-2) NEMA stated that majority of the lamps with a CRI of 87 or greater are 4-foot T12 lamps and are mainly used in residential applications, while 8-foot T12 lamps are mainly deployed in commercial spaces. (NEMA, No. 6 at p. 12) NEMA commented that DOE could consider including less than 4-foot fluorescent lamps in the scope, however, this lamp category exhibits significantly

lower energy use per lamp relative to 4-foot linear fluorescent lamps. NEMA added that it is unaware of any new fluorescent lamp or incandescent reflector lamp products coming to the market. (NEMA, No. 6 at p. 3)

Regarding exempt GSFLs, CEC supports two final rules DOE published on January 19, 2017, amending the definitions of GSL and GSIL[7], which included a revised definition for "designed and marketed" that would require markings to be prominently displayed. CEC asserted that DOE should reinstate the revised definition for "designed and marketed" in its evaluation of standards for GSFLs. CEC noted that the reinstated definition would require exempt GSFLs to be designed and marketed for their specialty application, limiting their use in general lighting applications. (CEC, No. 9 at pp. 3-4) ASAP et al added that if DOE decides to not set standards for impact-resistant fluorescent lamps, DOE should add a definition for these lamps to prevent potential loopholes. (ASAP et al, No. 5 at p. 5)

Based on information collected during manufacturer interviews, DOE determined that less than 4-foot fluorescent lamps are a small portion of the market and are decreasing in shipments. Therefore, DOE tentatively determined that standards for less than 4-foot lamps were unlikely to result in significant energy savings. Further, because these lamps are not regulated and yet are decreasing in shipments, DOE tentatively concluded that continuing to exclude these lamp types from the GSFL definition would likely not create a loophole in current standards for GSFLs. Regarding lamps with a CRI of 87 or greater and impact-resistant fluorescent lamps, these are exemptions stated in the

[7] On January 19, 2017, DOE published two related final rules amending the definitions of GSL and GSIL by discontinuing certain exemptions for some lamps that Congress originally excluded from those definitions. 82 FR 7276; 82 FR 7322 ("January 2017 Final Rules"). DOE subsequently issued a final rule withdrawing the January 2017 final rules. 84 FR 46661, 46664 (Sep. 5, 2019). The May 2022 Final Rule discussed in section II.B.2 of this document reinstated the amendments to the definitions of GSL and GSIL in the January 2017 Final Rules. 87 FR 27461.

statutory definition of "general service fluorescent lamp" (42 U.S.C. 6291(30)(B)) and it is not within the scope of DOE's authority in this rulemaking to modify these exemptions for GSFLs. Given that EPCA's statutory definition of "general service fluorescent lamp" contains a number of express exclusions for certain categories of fluorescent lamps, DOE finds no basis in the language of EPCA to support assertions that the agency's authority to act under section 325(i)(5) of EPCA is unlimited. DOE believes section 325(i)(5) covers additional GSFL *that are not one of the enumerated specialized products that EPCA excludes from coverage* (*See* 42 U.S.C. 6291(30)(B)). 73 FR 13620, 13629 (Mar. 13, 2008). (emphasis added). For these reasons, and for the additional reasons set forth in the March 2008 ANOPR, DOE views "additional" GSFL, as that term is used in 42 U.S.C. 6295(i)(5), as lamps that: (1) Meet the technical portion of the statutory definition of "fluorescent lamp" … (2) can be used to satisfy the majority of fluorescent lighting applications … ; (3) *are not within the exclusions from the definition of GSFL specified in 42 U.S.C. 6291(30)(B)*; and (4) are ones for which EPCA does not prescribe standards. 74 FR 16920, 16926-16928 (emphasis added).

ASAP et al commented that DOE should consider adopting a technology-agnostic approach that groups together all products that provide the same general lighting service. ASAP et al pointed out that TLEDs have gained market share at the expense of GSFLs over time and are marketed as suitable substitutes for GSFLs. ASAP et al noted that DOE has the broad authority to cover electric lights (42 U.S.C. 6311(2)(B)(v)) and any products that meet certain minimum consumption thresholds (42 U.S.C. 6295(l)(1)). (ASAP et al, No. 5 at p. 3)

DOE agrees with ASAP et al that TLEDs have gained market share at the expense of GSFLs over time and are marketed as suitable substitutes for GSFLs. However, this

proposed determination addresses only GSFLs defined in 10 CFR 430.2. DOE is not authorized to consider any product not meeting this definition, such as TLEDs, as a part of this proposed determination.

2. Technology Options

In the May 2020 RFI, DOE identified several technology options that would be expected to improve the efficiency (*i.e.,* efficacy or lumens per watt) of GSFLs, as measured by the DOE test procedure. To develop a list of technology options, DOE reviewed manufacturer catalogs, recent trade publications, technical journals, and the January 2015 final rule.

In response to the May 2020 RFI, ASAP et al commented that lamps currently covered by standards include technology options that can be applied to the lamp types that can be added to scope, and DOE should evaluate these technology options for potential scope additions. (ASAP et al, No. 5 at p. 5) As discussed in section IV.B.1 of this NOPD, DOE has tentatively determined that modifications to the scope of lamps included as GSFLs are either not possible or not likely to result in significant energy savings.

DOE conducted research for this NOPD to identify new technology options for GSFLs. DOE identified mercury isotopes as a technology option that can be implemented to improve the efficiency of GSFLs. Mercury used in GSFLs is composed of seven different isotopes, each having a distinct excited state that provides ultraviolet ("UV") light. The abundance of these isotopes can be altered to optimize the amount of UV light emitted and increase the efficiency of the lamp. For more detail on this technology option see chapter 3 of the NOPD TSD. In summary, for this analysis, DOE

considers the technology options shown in Table IV.1 of this document. These options are the same ones presented in the May 2020 RFI with the addition of mercury isotopes. Detailed descriptions of these technology options can be found in chapter 3 of the NOPD TSD.

Table IV.1 GSFL Technology Options

Technology Option	Description
Highly Emissive Electrode Coatings	Improved electrode coatings allow electrons to be more easily removed from electrodes, reducing lamp power and increasing overall efficacy.
Higher Efficiency Lamp Fill Gas Composition	Fill gas compositions improve cathode thermionic emission or increase mobility of ions and electrons in the lamp plasma.
Higher Efficiency Phosphors	Phosphors increase the conversion of UV light into visible light.
Glass Coatings	Coatings on inside of bulb enable the phosphors to absorb more UV energy, so that they emit more visible light.
Higher Efficiency Lamp Diameter	Optimal lamp diameters improve lamp efficacy.
Multi-Photon Phosphors	Phosphors emit more than one visible photon for each incident UV photon.
Mercury Isotopes	The abundance of mercury isotopes can be altered to optimize the amount of UV light emitted and increase the efficiency of the lamp.

3. Screening Analysis

DOE uses the following five screening criteria to determine which technology options are suitable for further consideration in an energy conservation standards rulemaking:

(1) *Technological feasibility*. Technologies that are not incorporated in commercial products or in working prototypes will not be considered further.

(2) *Practicability to manufacture, install, and service*. If it is determined that mass production and reliable installation and servicing of a technology in commercial products could not be achieved on the scale necessary to serve

the relevant market at the time of the projected compliance date of the standard, then that technology will not be considered further.

(3) *Impacts on product utility or product availability*. If it is determined that a technology would have significant adverse impact on the utility of the product to significant subgroups of consumers or would result in the unavailability of any covered product type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as products generally available in the United States at the time, it will not be considered further.

(4) *Adverse impacts on health or safety*. If it is determined that a technology would have significant adverse impacts on health or safety, it will not be considered further.

(5) *Unique-Pathway Proprietary Technologies*. If a design option utilizes proprietary technology that represents a unique pathway to achieving a given efficiency level, that technology will not be considered further due to the potential for monopolistic concerns.

Sections 6(b)(3) and 7(b) of appendix A. In summary, if DOE determines that a technology, or a combination of technologies, fails to meet one or more of the listed five criteria, it will be excluded from further consideration in the engineering analysis.

a. Screened-Out Technologies

For this analysis, DOE found that multi-photon phosphors are still not used in working prototypes or in commercially available products. DOE did not receive any

comments on the screening analysis for GSFLs. In this NOPD, as it did in the January 2015 final rule (80 FR 4042, 4061), DOE continues to screen out multi-photon phosphors. Regarding the new technology option identified for this NOPD, DOE was not able to find mercury isotopes utilized in working prototypes or in commercially available products. Therefore, in this NOPD, DOE has screened out mercury isotopes based on technological feasibility. See chapter 4 of the NOPD TSD for further details on the GSFL screening analysis.

b. Remaining Technologies

After reviewing each technology, DOE did not screen out the following technology options and considers them as design options in the engineering analysis:

(1) Highly Emissive Electrode Coatings

(2) Higher Efficiency Lamp Fill Gas Composition

(3) Higher Efficiency Phosphors

(4) Glass Coatings

(5) Higher Efficiency Lamp Diameter

DOE determined that these technology options are technologically feasible because they are being used or have previously been used in commercially available products or working prototypes. DOE also finds that all of the remaining technology options meet the other screening criteria *(i.e.,* practicable to manufacture, install, and service and do not result in adverse impacts on consumer utility, product availability, health, or safety). For additional details, see chapter 4 of the NOPD TSD.

4. Product Classes

In general, when evaluating and establishing energy conservation standards, DOE divides the covered product into classes by (1) the type of energy used, (2) the capacity of the product, or (3) any other performance-related feature that affects energy efficiency and justifies different standard levels, considering factors such as consumer utility. (42 U.S.C. 6295(q))

a. Existing Product Classes

For GSFLs, the current energy conservation standards specified in 10 CFR 430.32(n)(4) are based on 12 product classes, separated according to the following three factors: (1) correlated color temperature ("CCT"); (2) physical constraints of lamps (*i.e.*, lamp shape and length); and (3) lumen package (*i.e.*, standard output ("SO") versus high output ("HO")).

NEMA and CA IOUs commented that there is no need for any changes to product classes or groupings, as the GSFL category is a mature and well-established technology and the current GSFL product classes adequately cover the GSFL products on the market today. NEMA commented that separating or combining any GSFL product classes would eliminate some features. (NEMA, No. 6 at p. 3) CA IOUs stated that any new GSFL product classes could create additional loopholes in the GSFL standards. (CA IOUs, No. 8 at p. 3) DOE agrees that the existing product classes sufficiently cover the GSFLs on the market. Therefore, DOE is not proposing any amendments to the existing GSFL product classes.

b. Summary

In this analysis, DOE proposes to maintain separate product classes for GSFLs based on the following three factors: (1) CCT (*i.e.,* less than or equal to versus greater than 4,500 K); (2) physical constraints of lamps (*i.e.*, lamp shape and length); and (3) lumen package (*i.e.,* standard output versus high output). In summary, DOE assesses the product classes shown in Table IV.2 in its analysis.

Table IV.2 GSFL Product Classes

Lamp Type	CCT
4-foot medium bipin	≤ 4,500 K
	> 4,500 K
2-foot U-shaped	≤ 4,500 K
	> 4,500 K
8-foot single pin slimline	≤ 4,500 K
	> 4,500 K
8-foot recessed double contact high output	≤ 4,500 K
	> 4,500 K
4-foot T5, miniature bipin standard output	≤ 4,500 K
	> 4,500 K
4-foot T5, miniature bipin high output	≤ 4,500 K
	> 4,500 K

C. Engineering Analysis

The purpose of the engineering analysis is to establish the relationship between efficiency and cost for GSFLs. There are two elements to consider in the engineering analysis; the selection of efficiency levels to analyze (*i.e.*, the "efficiency analysis") and the determination of product cost at each efficiency level (*i.e.*, the "cost analysis"). In determining the performance of higher-efficiency products, DOE considers technologies and design option combinations not eliminated by the screening analysis. For each product class, DOE estimates the baseline cost, as well as the incremental cost for the product at efficiency levels above the baseline. The output of the engineering analysis is

a set of cost-efficiency "curves" that are used in downstream analyses (*i.e.*, the LCC and PBP analyses and the NIA).

1. Efficiency Analysis

DOE typically uses one of two approaches to develop energy efficiency levels for the engineering analysis: (1) relying on observed efficiency levels in the market (*i.e.*, the efficiency-level approach), or (2) determining the incremental efficiency improvements associated with incorporating specific design options to a baseline model (*i.e.*, the design-option approach). Using the efficiency-level approach, the efficiency levels established for the analysis are determined based on the market distribution of existing products (in other words, based on the range of efficiencies and efficiency level "clusters" that already exist on the market). Using the design option approach, the efficiency levels established for the analysis are determined through detailed engineering calculations and/or computer simulations of the efficiency improvements from implementing specific design options that have been identified in the technology assessment. DOE may also rely on a combination of these two approaches. For example, the efficiency-level approach (based on actual products on the market) may be extended using the design option approach to interpolate to define "gap fill" levels (to bridge large gaps between other identified efficiency levels) and/or to extrapolate to the max-tech level (particularly in cases where the max-tech level exceeds the maximum efficiency level currently available on the market).

In this proposed determination, DOE is adopting an efficiency-level approach for GSFLs. In this NOPD, efficiency levels are referred to as efficacy levels ("ELs") because GSFL efficiency is reported in terms of lumens per watt, which is known as the lamp's efficacy. DOE derives efficacy levels in the efficiency analysis and end-user

prices in the cost analysis. DOE estimates the end-user price of GSFLs directly because reverse-engineering a lamp is impractical as the lamps are not easily disassembled. By combining the results of the efficiency analysis and the cost analysis, DOE derives typical inputs for use in the LCC and NIA. Section IV.C.2 discusses the cost analysis (*see* chapter 5 of the NOPD TSD for further details).

The methodology for the efficiency analysis consists of the following steps: (1) select representative product classes, (2) select baseline lamps, (3) identify more efficacious substitutes, (4) develop efficacy levels by directly analyzing representative product classes, and (5) scale efficacy levels to non-representative product classes. The details of the efficiency analysis are discussed in chapter 5 of the NOPD TSD.

NEMA commented that since GSFL technologies are fully mature, the previous analytical conclusions continue to be accurate when it comes to use of certain combinations of design options. NEMA strongly opposed any amendments to the current GSFL efficiency levels, stating that since any new research in this market segment is unlikely, the increase in efficiency levels threatens to significantly reduce the product offerings. (NEMA, No. 6 at pp. 7-8)

DOE agrees with NEMA that fluorescent is a more mature technology than LED, meaning that the rates of product development for the former are much slower than the rate for the latter. In the efficiency analysis, DOE reviews products certified in DOE's compliance certification database and offered in manufacturer catalogs and on retailer websites. DOE bases its more efficient substitutes on products currently or formerly offered for sale on the market. The more efficient substitutes and corresponding efficacy levels are discussed in more detail in the following sections.

a. Representative Product Classes

In the case where a covered product has multiple product classes, DOE identifies and selects certain product classes as "representative" and concentrates its analytical effort on those classes. DOE chooses product classes as representative primarily because of their high market volumes. DOE then scales its analytical findings for those representative product classes to other product classes that are not directly analyzed. Based on its assessment of product offerings, DOE analyzed as representative all GSFLs with CCTs less than or equal to 4,500 K with the exception of the 2-foot U-shaped lamps, as shown in gray in Table IV.3 of this document. DOE did not directly analyze GSFLs with CCTs greater than 4,500 K or GSFLs that are 2-foot U-shaped lamps of any CCT due to low shipment volumes.

Table IV.3. GSFL Representative Product Classes

Lamp Type	CCT
4-foot medium bipin	≤ 4,500 K
	> 4,500 K
2-foot U-shaped	≤ 4,500 K
	> 4,500 K
8-foot single pin slimline	≤ 4,500 K
	> 4,500 K
8-foot recessed double contact high output	≤ 4,500 K
	> 4,500 K
4-foot T5, miniature bipin standard output	≤ 4,500 K
	> 4,500 K
4-foot T5, miniature bipin high output	≤ 4,500 K
	> 4,500 K

b. Baseline Lamps

For each representative product class, DOE generally selects a baseline model as a reference point for each class, and measures changes resulting from potential energy conservation standards against the baseline. The baseline model in each product class

represents the characteristics of a product typical of that class (*e.g.,* capacity, physical size). Generally, a baseline model is one that just meets current energy conservation standards, or, if no standards are in place, the baseline is typically the most common or least efficient unit on the market. Typically, the baseline lamp is the most common, least efficacious lamp that meets existing standards. In this analysis, DOE selected as baselines the least efficacious lamps meeting standards that have common attributes for lamps in each product class such as diameter, wattage, CCT, lumen output, and lifetime.

NEMA commented that any review of reported lamp efficiencies for determining baseline models in each product class should start with DOE's compliance certification database. (NEMA, No. 6 at p. 7).

To identify baseline lamps for this analysis, DOE reviewed data in the compliance certification database, product offerings in catalogs and on retailer websites, and manufacturer feedback obtained during interviews. DOE used the efficacy values of lamps in the compliance certification database to select baseline lamps. For representative product classes without certification data at the baseline, DOE used catalog and retailer data to select a baseline lamp. Specifically, DOE selected a baseline lamp from a retailer for the 8-foot single pin ("SP") slimline product class because DOE was unable to identify any lamp in the compliance certification database that just meets the existing standards with common attributes for lamps in the product class.

DOE is proposing the GSFL baseline lamps specified in Table IV.4. See chapter 5 of the NOPD TSD for more detail.

Table IV.4 GSFL Baseline Lamps

Representative Product Class	Lamp Diameter	Nominal Wattage	Efficacy**	Initial Lumen Output	Mean Lumen Output	Rated Life***	CRI
		W	*lm/W*	*lm*	*lm*	*hr*	
4-foot MBP	T8	32	92.4	3,050	2,910	24,000	85
8-foot SP slimline	T8	59	98.2	5,900	5,430	15,000	82
8-foot RDC HO	T8	86	94.6	8,000	7,520	18,000	78
4-foot T5 MiniBP SO*	T5	28	95.9	2,610	2,453	24,000	85
4-foot T5 MiniBP HO*	T5	54	83	4,500	4,140	30,000	85

* 4-foot T5 MiniBP SO and HO initial lumen output, and mean lumen output given at 25 °C. Initial and mean lumens are calculated from catalog lumens at 35°C by applying a 10 percent lumen reduction.

** Efficacy is from the compliance certification database, if available, or catalog initial lumen output divided by the American National Standards Institute ("ANSI") rated wattage if the lamp does not have certification data

*** Rated life is based on an instant start ballast with 3 hour starts for the 4-foot MBP and 8-foot SP slimline product classes and a programmed start ballasts with 3 hour starts for all other product classes

c. More Efficacious Substitutes

As part of DOE's analysis, the maximum available efficiency level is the highest efficiency unit currently available on the market. DOE also defines a "max-tech" efficiency level to represent the maximum possible efficiency for a given product. DOE selects more efficacious replacements for the baseline lamps considered within each representative product class. DOE considers only design options identified in the screening analysis. More efficacious substitutes were selected such that, where possible, potential substitutions maintained light output within 10 percent of the baseline lamp's light output. DOE also sought to keep characteristics of substitute lamps, such as CCT, CRI, and lifetime, as similar as possible to the baseline lamps. DOE used efficacy data from the compliance certification database to identify more efficacious substitutes in all product classes. DOE ensured that all more efficacious substitutes selected showed an improvement in efficacy of at least one percent from the previous level. DOE identified

more efficacious substitutes that typically represent a group of lamps in the compliance certification database with similar efficacy data. The GSFL representative lamps analyzed in the NOPR are shown in Table IV.5 of this document.

The CA IOUs commented that DOE should consider new information regarding the energy efficiency of available GSFLs. The CA IOUs pointed out that new and more efficient fluorescent lamps exceed the max-tech efficiency levels established in January 2015 final rule (*e.g.,* 4-foot T8 lamps can achieve 97 to 100 lm/W compared to the 2015 max-tech value of 92.4 lm/W). (CA IOUs, No. 8 at p. 2)

However, NEMA pointed out in its comments that DOE, while in pursuit of higher efficiencies, should be aware of newer test procedures for fluorescent lamps and the possibility of incorrectly testing efficiency by using a high frequency ballast, thus yielding an inflated efficiency level. If DOE did decide to pursue a new, higher baseline efficiency, then NEMA strongly recommended that DOE verify selected representative products to ensure that the efficiency levels are not inadvertently inflated. (NEMA, No. 6 at pp. 7-8)

NEMA concluded, upon review of the compliance certification database, that only T5 products have any opportunity for minimal efficiency gain and that although the T8 category may appear to have some room for improvement NEMA warns that efficiency gain opportunities may exist but at the expense of dimming functionality. (NEMA, No. 6 at pp. 12-13) Regarding dimming, NEMA stated that the fill gas in reduced wattage fluorescent lamps, krypton, adversely affects dimming capability and thus only 32 W 4-foot T8 lamps are recommended for dimming applications. Although the demand for fluorescent lamps continues a downward trend, an amended standard that eliminates the

32 W category would leave consumers with little choice other than converting to dimmable solid-state lighting. NEMA states that this scenario must be included in the cost-benefit analysis. (NEMA, No. 6 at p. 4)

For this analysis, DOE did consider new information regarding the efficacy of currently available GSFLs as compared to GSFLs available at the time of the January 2015 final rule. As described previously, DOE gathered recent product information from DOE's compliance certification database, manufacturer catalogs, and retailer websites. As shown in Table IV.5, DOE did identify max-tech levels in certain product classes that are higher than the max-tech levels identified in the January 2015 final rule. Regarding 4-foot T8 lamps, reduced wattage lamps available at the max-tech level are around the 100 lm/W value cited by the CA IOUs. However, as pointed out by NEMA, reduced wattage lamps do not maintain full dimming functionality due to the krypton fill gas. Therefore, DOE has established the efficacy level at the efficacy achieved by the most efficient 32 W lamp. DOE notes that the max-tech value for the 32 W 4-foot T8 lamp in this NOPD is higher than the max-tech value for the same product class in the January 2015 final rule.

Table IV.5 GSFL More Efficacious Substitutes

Product Classes	EL	Lamp Diameter	Nominal Wattage	Efficacy**	Initial Light Output	Mean Light Output	Rated Life***	CRI
			W	lm/W	lm	lm	hr	
4-foot MBP	EL 1	T8	32	93.6	3,200	3,010	24,000	85
	EL 2	T8	32	94.6	3,100	2,915	24,000	85
	EL 2	T8	25	100.8	2,300	2,230	32,000	85
	EL 2	T8	28	100.3	2,725	2,560	24,000	85
8-foot SP slimline	EL 1	T8	59	99.6	5,900	5,430	18,000	82
	EL 2	T8	59	102.8	6,100	5,730	24,000	85
	EL 2	T8	49	105.4	5,000	4,700	24,000	82
8-foot RDC HO	EL 1	T8	86	99.0	8,200	7,800	18,000	85
	EL 2	T8	86	108.4	8,200	7,710	18,000	85
T5 MiniBP SO*	EL 1	T5	28	97.0	2,610	2,394	30,000	85
	EL 2	T5	28	98.8	2,610	2,427	36,000	85
	EL 3	T5	28	100.8	2,610	2,408	24,000	82
	EL 3	T5	26	101.0	2,610	2,394	25,000	85
T5 MiniBP HO*	EL1	T5	54	85.6	4,500	4,185	30,000	85
	EL 1	T5	49	88.8	4,365	4,140	36,000	85
	EL 2	T5	54	89.8	4,500	4,050	30,000	82
	EL 2	T5	47	90	4,320	3,969	30,000	84
	EL 3	T5	54	96.4	4,365	4,140	36,000	85
	EL 3	T5	49	96.5	4,500	4,005	30,000	85

* 4-foot T5 MiniBP SO and HO rated efficacy, initial lumen output, and mean lumen output given at 25 °C. Initial and mean lumens are calculated from catalog lumens at 35°C by applying a 10 percent lumen reduction.

** Efficacy is from the compliance certification database, if available, or catalog/retailer initial lumen output divided by the ANSI rated wattage if the lamp does not have certification data.

*** Rated life is based on an instant start ballast with 3 hour starts for the 4-foot MBP and 8-foot SP slimline product classes and a programmed start ballasts with 3 hour starts for all other product classes.

d. Efficacy Levels

After identifying more efficacious substitutes for each of the baseline lamps, DOE develops ELs based on the consideration of several factors, including: (1) the design options associated with the specific lamps being studied (*e.g.*, grades of phosphor); (2) the ability of lamps across wattages to comply with the standard level of a given product class; and (3) max-tech level. Although fluorescent lamps are a component of a system

that often includes ballasts and fixtures, DOE based its ELs only on lamp performance because GSFLs are the subject of this proposed determination. DOE acknowledges, however, that the energy consumption of fluorescent lamps is related to the ballast on which they operate. Therefore, DOE pairs each lamp with an appropriate ballast to better approximate real-world conditions (see section IV.C.1.e of this document for more information).

To determine appropriate ELs, DOE used efficacy values of lamps certified in its compliance certification database. DOE considered only ELs at which a full wattage version of the lamp type was available because reduced wattage lamps have limited dimming capability.

Table IV.6 summarizes the ELs developed by the engineering analysis for GSFLs in this NOPD.

Table IV.6 Summary of ELs for GSFL Representative Product Classes

CCT	Lamp Type	Efficacy Level lm/W		
		1	2	3
≤ 4,500 K	4-foot MBP	93.6	94.6	N/A
	8-foot SP slimline	99.6	102.8	N/A
	8-foot RDC HO	99.0	108.4	N/A
	4-foot T5 MiniBP SO	97.0	98.8	100.8
	4-foot T5 MiniBP HO	85.6	89.8	96.4

e. Lamp-and-Ballast Systems

Because fluorescent lamps operate on a ballast in practice, DOE analyzed lamp-and-ballast systems in the engineering analysis. DOE determined that pairing a lamp with a ballast more accurately captures real-world energy use and light output.

DOE considered two different scenarios in the engineering analysis: (1) a lamp replacement scenario in which the consumer selects a replacement lamp that can operate on the installed ballast and (2) a lamp-and-ballast replacement scenario in which the consumer selects a new lamp and also selects a new ballast with potentially different performance characteristics, such as ballast factor[8] ("BF") or ballast luminous efficiency[9] ("BLE"). DOE only selected replacement systems that do not have higher energy consumption than the baseline system.

For both substitution scenarios, DOE determined energy consumption by calculating the system input power of the lamp-and-ballast system. The system input power represents the energy consumption rate of both the lamp and ballast, and therefore is greater than the rated power of the lamp alone. In addition to the rated lamp power, the system input power is also affected by the number of lamps operated per ballast, BLE of ballast used, starting method, and the BF of that ballast.

f. Scaling to Other Product Classes

As noted previously, DOE analyzes the representative product classes directly. DOE then scales the levels developed for the representative product classes to determine levels for product classes not analyzed directly. For GSFLs, the representative product classes analyzed were all lamp types with CCTs ≤ 4,500 K, with the exception of 2-foot

[8] BF is defined as the output of a ballast delivered to a reference lamp in terms of power or light divided by the output of the relevant reference ballast delivered to the same lamp (ANSI C82.13-2002). Because BF affects the light output of the system, manufacturers design ballasts with a range of ballast factors to allow consumers to vary the light output, and thus power consumed, of a fluorescent system. See the fluorescent lamp ballast ("FLB") final determination (published on October 22, 2019, 85 FR 81558) TSD Chapter 3. The FLB ECS final determination materials are available at *www.regulations.gov/docket?D=EERE-2015-BT-STD-0006*.

[9] BLE is the ratio of the total lamp arc power to ballast input power, multiplied by the appropriate frequency adjustment factor.

U-shaped lamps. For the 2-foot U-shaped product class, DOE scaled from the efficacy levels developed for the 4-foot MBP product class.

Efficacy levels developed for lamp types with CCTs less than or equal to 4,500 K were scaled to obtain levels for higher CCT product classes not analyzed. DOE found variation in the percent reduction in efficacy associated with increased CCT among product classes and therefore chose to develop a separate scaling factor for each product class. DOE developed scaling factors by identifying pairs and comparing the efficacies between the same lamp type from the same manufacturer within the same product class but that differed by CCT.

For 2-foot U-shaped lamps, DOE compared catalog and certification data for 2-foot U-shaped lamps with equivalent 4-foot MBP lamps, and determined an average efficacy reduction of 6 percent from the 4-foot MBP lamps was appropriate. For the higher CCT product classes, DOE determined a 4 percent scaling factor for the 4-foot MBP product class, 2 percent scaling factor for the 2-foot U-shaped product class, 3 percent scaling factor for the 8-foot SP slimline product class, 3 percent scaling factor for the 8-foot RDC HO product class, 6 percent scaling factor for the T5 SO product class, and 6 percent scaling factor for the T5 HO product class were appropriate.

Regarding the max efficacy achievable by 2-foot U-shaped lamps, NEMA commented that the information outlined in DOE's compliance certification database is available and that the sales of U-shaped 1 5/8" lamps are lower than U-shaped 6" lamps sales. (NEMA, No. 6 at p. 4) NEMA further added that the scaling factors developed in the prior rulemaking pertaining to the average efficacy difference between 2-foot MBP

and 4-foot MBP lamps, and between lamps with CCT less than 4,500 K and CCT greater than 4,500 K, are still adequate and do not require any revision. (NEMA, No. 6 at p. 8)

As described previously in this section, DOE has calculated scaling factors for each product class to scale from lamps with CCTs less than 4,500 K to lamps with CCTs greater than 4,500 K. These scaling factors are the same as those used in the January 2015 final rule with the exception of the scaling factors for the 8-foot RDC HO (3 percent instead of 4 percent) and T5 HO (6 percent instead of 7 percent) product classes. DOE also calculated a scaling factor for 2-foot U-shaped lamps and found it to be 6 percent instead of the 8 percent used in the January 2015 final rule. DOE determined the updated scaling factors by considering efficacy data for lamps in the compliance certification database and catalog data. DOE updated the scaling factor in cases where both data sources indicated that the existing scaling factors do not capture the difference in efficacy of the scaled lamp types. DOE determined that the updated scaling factors more accurately represent lamps currently on the market. Regarding the different leg spacings of 2-foot U-shaped lamps, DOE compared the scaled ELs to available certification data and confirmed that 2-foot U-shaped lamps with both 6-inch and 1 5/8-inch leg spacings can meet the analyzed ELs. Table IV.7 summarizes the ELs for all GSFL product classes.

Table IV.7 Summary of All Efficacy Levels for GSFLs

CCT	Lamp Type	Efficacy Level		
		1	2	3
≤ 4,500 K	4-foot medium bipin	93.6	94.6	-
	2-foot U-shaped	88.0	88.9	-
	8-foot single pin slimline	99.6	102.8	-
	8-foot recessed double contact HO	99.0	108.4	-
	4-foot T5 miniature bipin SO	97.0	98.8	100.8
	4-foot T5 miniature bipin HO	85.6	89.8	96.4
> 4,500 K	4-foot medium bipin	89.9	90.8	-
	2-foot U-shaped	86.2	87.1	-
	8-foot single pin slimline	96.6	99.7	-
	8-foot recessed double contact HO	96.0	105.1	-
	4-foot T5 miniature bipin SO	91.2	92.9	94.8
	4-foot T5 miniature bipin HO	80.5	84.4	90.6

2. Cost Analysis

The cost analysis portion of the Engineering Analysis is conducted using one or a combination of cost approaches. The selection of cost approach depends on a suite of factors, including the availability and reliability of public information, characteristics of the regulated product and the availability and timeliness of purchasing the GSFLs on the market. The cost approaches are summarized as follows:

- *Physical teardowns*: Under this approach, DOE physically dismantles a commercially available product, component-by-component, to develop a detailed bill of materials for the product.

- *Catalog teardowns*: In lieu of physically deconstructing a product, DOE identifies each component using parts diagrams (available from

manufacturer websites or appliance repair websites, for example) to develop the bill of materials for the product.

- *Price surveys*: If neither a physical nor catalog teardown is feasible (for example, for tightly integrated products such as fluorescent lamps, which are infeasible to disassemble and for which parts diagrams are unavailable) or cost-prohibitive and otherwise impractical (*e.g.*, large commercial boilers), DOE conducts price surveys using publicly available pricing data published on major online retailer websites and/or by soliciting prices from distributors and other commercial channels.

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In the present case, DOE conducted the analysis using the price survey approach. Typically, DOE develops manufacturing selling prices ("MSPs") for covered products and applies markups to create end-user prices to use as inputs to the LCC analysis and NIA. Because GSFLs are difficult to reverse-engineer (*i.e.*, not easily disassembled), DOE directly derives end-user prices for the lamps covered in this proposed determination. The end-user price refers to the product price a consumer pays before tax and installation. Because GSFLs operate with a ballast in practice, DOE also incorporated prices for ballasts that operate those lamps.

In its review of publicly available prices for GSFLs, DOE observed a range of end-user prices paid for a lamp, depending on the distribution channel through which the lamp was purchased. DOE identified the following three main distribution channels: small consumer-based distributors (*i.e.*, internet retailers, drug stores); large retail

distributors: (*i.e.*, home centers, mass merchants, hardware stores, and electrical distributors); and state procurement.

For each distribution channel, DOE calculated an average price for the representative lamp unit at each EL using prices for the representative lamp unit and similar lamp models at the same level. Because the lamps included in the calculation were equivalent to the representative lamp unit in terms of performance and utility (*i.e.*, had similar wattage, CCT, shape, base type, CRI, and technology), DOE considered the pricing of these lamps to be representative of the technology of the EL. DOE developed average end-user prices for the representative lamp units sold in each of the three main distribution channels analyzed. DOE then calculated an average weighted end-user price using estimated shipments through each distribution channel. Table IV.8 summarizes the weightings used for the GSFL main distribution channels. Table IV.9 summarizes the weightings within the large retail distributors. The cost analysis methodology is explained in more detail in chapter 5 of the NOPD TSD.

Table IV.8 Weightings for GSFL Distribution Channels

Main Channels	Weighting
State Procurement	10%
Large retail distributors	70%
Online Retailers	20%

Table IV.9 Weightings Within Large Retail Distributor Channel

Main Channels	Description	GSFL Weighting
Large Retail Distributors	Mass merchants and Home centers	11%
	Hardware stores	1%
	Electrical distributors	88%

D. Energy Use Analysis

The purpose of the energy use analysis is to determine the annual energy consumption of GSFLs at different efficiencies in representative U.S. single-family homes, multi-family residences, and commercial buildings, and to assess the energy savings potential of increased GSFL efficiency. The energy use analysis estimates the range of energy use of GSFLs in the field (*i.e.*, as they are actually used by consumers). The energy use analysis provides the basis for other analyses DOE performed, particularly assessments of the energy savings and the savings in consumer operating costs that could result from adoption of amended or new standards.

Tables 6.4.1 through 6.4.10 in section 6.4 of the January 2015 final rule TSD present the average energy consumption for each GSFL product class and efficiency level. DOE has tentatively concluded that the current average energy consumption for these products is comparable to the estimates developed in the January 2015 final rule, as the wattage options have not changed substantially for most products classes. Max-tech parameters, including system arc power, BF, and BLE have been updated to account for the max-tech levels described in section IV.C of this proposed determination. NEMA suggested that the 2015 DOE Lighting Market Characterization Report[10] (2015 LMC) should be used for operating hours for GSFLs. (NEMA, No. 6 at pp.8-9). DOE agrees that the operating hours in the 2015 LMC are appropriate. The 8.1 average daily operating hours in the commercial sector from the 2015 LMC translate to lower energy use and thus lower potential energy savings from GSFLs compared to the estimated 11.1 average daily operating hours in the commercial sector in the January 2015 final rule.

[10] 2015 U.S. Lighting Market Characterization. U.S. Department of Energy, available at *www.energy.gov/eere/ssl/2015-us-lighting-market-characterization*

Chapter 6 of the NOPD TSD provides details on DOE's energy use analysis for GSFLs.

E. Life-Cycle Cost and Payback Period Analysis

DOE conducts LCC and PBP analyses to evaluate the economic impacts on individual consumers of potential energy conservation standards for GSFLs. The effect of new or amended energy conservation standards on individual consumers usually involves a reduction in operating cost and an increase in purchase cost. DOE typically uses the following two metrics to measure consumer impacts:

- The LCC is the total consumer expense of an appliance or product over the life of that product, consisting of total installed cost (manufacturer selling price, distribution chain markups, sales tax, and installation costs) plus operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the product.

- The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of a more-efficient product through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost at higher efficiency levels by the change in annual operating cost for the year that amended or new standards are assumed to take effect.

Based on the rapidly declining shipments of GSFLs, limited and uncertain energy savings opportunity, and potential impacts on manufacturers, as discussed in sections IV.D, IV.F, and V.C of this NOPD, DOE did not conduct LCC and PBP analyses to

evaluate the economic impacts on individual consumers of amended GSFL energy conservation standards.

F. Shipments Analysis

DOE uses projections of annual product shipments to calculate the national impacts of potential amended or new energy conservation standards on energy use, NPV, and future manufacturer cash flows.[11] The shipments model takes an accounting approach in tracking market shares of each product class and the vintage of units in the stock. Stock accounting uses product shipments as inputs to estimate the age distribution of in-service product stocks for all years. The age distribution of in-service product stocks is a key input to calculations of both the NES and NPV, because operating costs for any year depend on the age distribution of the stock. DOE used a model coded in the Python programming language to compute an estimate of shipments and stock in each projection year up through the end of the analysis period (2021 – 2055). DOE included 4-foot T8, 4-foot T5 standard output and 4-ft T5 high output representative lamps in its shipments model. While T8 lamps represent the largest part of the GSFL market, the T5 product classes have engineering options with lower wattage options at higher ELs that may result in energy savings for consumers. The 8-foot recessed double-contact high-output product class does not include any lamp options at higher ELs that reduce energy compared to the baseline lamp, and the only lamp option in the 8-foot slimline product class that would reduce energy consumption does not offer the same utility as the other representative lamp options because its lumen output is more than 10 percent lower. These lamp categories with smaller markets and without potential energy savings at

[11] DOE uses data on manufacturer shipments as a proxy for national sales, as aggregate data on sales are lacking. In general, one would expect a close correspondence between shipments and sales.

higher efficiency levels were excluded from analysis due to the fact that there would be either no or miniscule savings.

DOE seeded this model with estimates of total historical shipments derived from the January 2015 final rule (up through data year 2015) and sales indices of the linear lamp market published by NEMA[1] (for data years 2015 – 2020). These indices show a steep decline of GSFL sales for lamps of all types over this five year period. In order to account for LED competition for GSFL applications, DOE included representative T8 and T5 LED replacement lamps in the shipments model (see the chapter 8 of the NOPD TSD for details). DOE assumed that in each shipments projection year, demand for replacements would be the only source of demand for new lamp purchases. Demand for replacement lamps in each year is allotted among available replacement options using a consumer choice model that derives market share based on the features of available representative lamps. This model includes consumer sensitivity to price, lifetime, energy savings, and mercury content as measured in a market study[12] of consumer preference for lamps. Though these parameters represent the preference of residential consumers, DOE adopted them for the linear lamp market in the absence of available alternatives. DOE expects that because these parameters place more weight on first-cost than other attributes, the model results in a conservative estimate of LED adoption since commercial and industrial consumers are more likely to weigh decreases in operating costs in purchasing decisions.

DOE assumes that the purchase price of TLED lamp options will drop over the course of the analysis period due to price learning associated to cumulative shipments of

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[12] Steven Krull and Dan Freeman, "Next Generation Light Bulb Optimization" (Pacific Gas and Electric Company, February 10, 2012), *https://www.etcc-ca.com/sites/default/files/OLD/images/stories/Lighting_Conjoint_Study_v020712f.pdf*.

LED lamps of all types (consistent with the price learning analysis detailed in a LBNL report on the impact of the GSL backstop[13]). Further, DOE assumes that while consumers may replace fluorescent lamps with either a fluorescent or TLED lamp option, those with failing LEDs will only opt for an LED replacement. Lastly, DOE applies an efficiency trend, based on a fit to projections of linear fixture efficiency from the 2019 Solid State Lighting Report[14], to the most efficient LEDs available. Over the course of the shipments projection period, the application of this trend expands the range of available LED efficiencies and attempts to account for increases in LED market share that would occur as a result of this shift. Due in part to these assumptions, the shipments model projects that the linear lamp market continues to shift quickly towards LED over the analysis period in the no-new-standards case. See the chapter 8 of the NOPD TSD for more details.

DOE also assumed that a fixed fraction of all tubular lamp stock in each year will leave the market due to retrofits or renovation with integrated LED fixtures. This assumption has the effect of reducing the number of lamps that might retire, and therefore the size of the market, in each year.

NEMA commented that their data shows a much more aggressive decline than the assumption in the January 2015 final rule which accounts for the penetration of LED lighting into GSFL markets. (NEMA, No. 6 at p. 10). Additionally, during manufacturer interviews, manufacturers commented that the market is shifting to LED technology in

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[13] C.L.S. Kantner et al., "Impact of the EISA 2007 Backstop Requirement on General Service Lamps" (Berkeley, CA: Lawrence Berkeley National Laboratory, December 2021), *https://eta.lbl.gov/publications/impact-eisa-2007-backstop-requirement.*

[14] Navigant Consulting, Inc., "Energy Savings Forecast of Solid-State Lighting in General Illumination Applications" (Washington, D.C.: U.S. Department of Energy, December 2019), *https://www.energy.gov/eere/ssl/downloads/2019-ssl-forecast-report*.

the GSFL markets. Most manufacturers commented that there has been a 20 to 40 percent decline in shipments for GSFLs each year that is expected to continue absent new standards for GSFLs. This decline is greater than that projected in the January 2015 final rule, and more in line with the projected market share estimated in this proposed determination.

G. National Energy Savings

The NIA assesses the NES and the NPV from a national perspective of total consumer costs and savings that would be expected to result from new or amended standards at specific efficiency levels.[15] DOE calculates the NES and NPV for the potential standard levels considered based on projections of annual product shipments, along with the annual energy consumption and total installed cost data estimated or provided from other sources. For the present analysis, DOE projected the energy savings, operating cost savings, product costs, and NPV of consumer benefits over the lifetime of GSFLs sold from 2026 through 2055.

DOE evaluates the effects of new or amended standards by comparing a case without such standards with standards-case projections. The no-new-standards case characterizes energy use and consumer costs for each GSFL class in the absence of new or amended energy conservation standards. The efficiency distribution is projected using a consumer-choice model, as discussed in section IV.F, and takes into account competition from TLED substitutes. DOE compares the no-new-standards case with projections characterizing the market for each product class if DOE adopted new or amended standards at specific energy efficiency levels (*i.e.*, the ELs or standards cases) for that class. For the standards cases, consistent with the approach in the no-new-

[15] The NIA accounts for impacts in the 50 states and Washington D. C.

standards case, DOE considers how a given standard would likely affect the market shares of GSFLs with efficiencies greater than the standard and TLED substitutes using the consumer-choice model discussed previously.

The only potential standard for which NES and NPV were calculated was the max-tech levels, where the standard for each GSFL product class is set at the maximum available level. NES and NPV at this candidate standard define an upper bound on how much savings could be realized at any lower standard.

Because a LCC analysis was not performed for consumers of lamps covered under this analysis, DOE estimated the per-unit annual energy use of available GSFL options based on nominal wattages derived during the engineering analysis (described in section IV.C) and separate average hours-of-use (HOU) estimates for individual sectors.

To estimate the HOU for linear lamps in the residential sector, DOE scaled the average HOU estimated for A-type medium screw-base lamps in DOE's 2016 GSL NOPR analysis. 81 FR 14528 (Mar. 16, 2016) The national-average HOU for A-type lamps in the residential sector was estimated to be 2.3 hours/day based on DOE's 2016 GSL NOPR analysis, which considered a number of field metering studies conducted across the U.S. DOE developed a scaling factor for linear lamps using the distribution of room types that linear lamps are typically installed in and the HOU associated with those room types, relative to the distribution of room types and associated HOU for A-type lamps. Room-specific average HOU data came from NEEA's 2014 Residential Building Stock Assessment Metering Study (RBSAM)[16] and room distribution data by lamp type

[16] Ecotope Inc. Residential Building Stock Assessment: Metering Study. 2014. Northwest Energy Efficiency Alliance: Seattle, WA. Report No. E14-283. (Last accessed December 5, 2019.) *https://neea.org/data/residential-building-stock-assessment*.

came from a 2010 KEMA report.[17] DOE estimated the national weighted-average HOU of linear lamps to be 2.1 hours per day in the residential sector. See chapter 9 of this NOPD TSD for more detail.

In order to estimate HOU for linear lamps in the commercial sector, DOE took HOU estimates from the 2015 LMC of linear fluorescent lamps for the commercial buildings present in that report. The building-specific HOU for these lamps was weighted by the relative floor space of each building type as reported in the 2015 LMC. The national weighted-average HOU for linear lamps GSLs in the commercial sector were estimated at 8.1 hours per day.

DOE derived LED alternatives to the T8 GSFL lamps represented in this analysis by looking at the efficiency and estimated cost of TLED lamps found in manufacturer catalogs and retailer websites (in order of data priority). DOE chose seven total TLED lamps ranging from 120 to 177 lumens per watt, and an estimated pre-tax price of $8.78 to $14.20 in 2021 USD. DOE assumed that the efficiency of T5 and 8-foot TLED lamps would be the same as LED T8 lamps, and estimated their wattage by assuming they would have the same lumen output of their GSFL competitors described in the engineering analysis. Like with the GSFLs, the annual energy use of TLED lamps was estimated using average hours of use and wattage. The price of any given T5 or 8-foot LED alternative is estimated as the sum of (a) the cost of the least efficient GSFL option of that lamp type, and (b) the incremental cost between the least efficient T8 GSFL and

[17] KEMA, Inc. Final Evaluation Report: Upstream Lighting Program: Volume 2. 2010. California Public Utilities Commission, Energy Division: Sacramento, CA. Report No. CPU0015.02. (Last accessed March 14, 2016.) *https://www.calmac.org/publications/FinalUpstreamLightingEvaluationReport_Vol2_CALMAC.pdf.*

the LED T8 with the same efficiency as the given lamp. See the chapter 8 and chapter 9 of the NOPD TSD for more details.

DOE uses a model written in the python programming language to calculate the energy savings and the national consumer costs and savings from each EL.

Table IV.10 summarizes the inputs and methods DOE used for the NIA analysis for the NOPD.

Table IV.10 Summary of Inputs and Methods for the National Impact Analysis

Inputs	Method
Shipments	Annual shipments from shipments model.
Modeled Compliance Date of Standard	2026
Annual Energy Consumption per Unit	Energy consumption values of modeled representative lamps are a function of EL.
Total Installed Cost per Unit	Purchase price of modeled representative lamps.
Electricity Prices	AEO2021 projections (to 2050) and extrapolation through 2055
Energy Site-to-Primary and FFC Conversion	A time-series conversion factor based on AEO2021.
Discount Rate	3 percent and 7 percent
Present Year	2022 (the year to which NPV is discounted)

1. Product Efficiency Trends

A key component of the NIA is the trend in energy efficiency projected for the no-new-standards case and each of the standards cases. DOE uses a shipments model that implements consumer choice over available lamp options in each year in order to compute the efficiency distribution. At each standard level and the no-new-standards case, the consumer choice model uses consumer sensitivity to price, relative energy savings, lamp lifetime, and mercury content to estimate the efficiency distribution of purchases in each year.

2. National Energy Savings

The NES analysis involves a comparison of national energy consumption of the considered products between each potential standards case and the case with no new or amended energy conservation standards. DOE calculated the national energy consumption by multiplying the number of units (stock) of each product (by vintage or age) by the unit energy consumption (also by vintage). DOE calculated annual NES based on the difference in national energy consumption for the no-new-standards case and for each higher efficiency standard case. DOE estimated energy consumption and savings based on site energy and converted the electricity consumption and savings to primary energy (*i.e.*, the energy consumed by power plants to generate site electricity) using annual conversion factors derived from *AEO2021*. Cumulative energy savings are the sum of the NES for each year over the timeframe of the analysis.

In 2011, in response to the recommendations of a committee on "Point-of-Use and Full-Fuel-Cycle Measurement Approaches to Energy Efficiency Standards" appointed by the National Academy of Sciences, DOE announced its intention to use FFC measures of energy use and greenhouse gas and other emissions in the NIA and emissions analyses included in future energy conservation standards rulemakings. 76 FR 51281 (Aug. 18, 2011). After evaluating the approaches discussed in the August 18, 2011 notice, DOE published a statement of amended policy in which DOE explained its determination that EIA's National Energy Modeling System ("NEMS") is the most appropriate tool for its FFC analysis and its intention to use NEMS for that purpose. 77 FR 49701 (Aug. 17, 2012). NEMS is a public domain, multi-sector, partial equilibrium model of the U.S. energy sector[18] that EIA uses to prepare its AEO. The

[18] For more information on NEMS, refer to *The National Energy Modeling System: An Overview 2009*, DOE/EIA-0581(2009), October 2009. Available at *www.eia.gov/analysis/pdfpages/0581(2009)index.php* (last accessed March 4, 2022).

FFC factors incorporate losses in production, and delivery in the case of natural gas, (including fugitive emissions) and additional energy used to produce and deliver the various fuels used by power plants. The approach used for deriving FFC measures of energy use and emissions is described in appendix 10B of the NOPD TSD.

3. Net Present Value Analysis

The inputs for determining the NPV of the total costs and benefits experienced by consumers are (1) total annual installed cost, (2) total annual operating costs (energy costs and repair and maintenance costs), and (3) a discount factor to calculate the present value of costs and savings. DOE calculates net savings each year as the difference between the no-new-standards case and each standards case in terms of total savings in operating costs versus total increases in installed costs. DOE calculates operating cost savings over the lifetime of each product shipped during the projection period.

DOE assumed that the price of TLED lamps would decrease over the analysis period due to price learning, as described in section IV.F of this document, which affected the market share projected by the shipments model. The gradual decrease in LED prices also affects the total installed cost over the analysis period, and has the effect of reducing lamp costs in both the standards- and no-new-standards cases as well as the incremental cost of a standard.

The operating cost savings are energy cost savings, which are calculated using the estimated energy savings in each year and the projected price of the appropriate form of energy. To estimate energy prices in future years, DOE multiplied the average regional energy prices by the projection of annual national-average residential energy price changes in the Reference case from *AEO2021*, which has an end year of 2050. To

estimate price trends after 2050, DOE assumed that prices would remain constant after 2050.

In calculating the NPV, DOE multiplies the net savings in future years by a discount factor to determine their present value. For this NOPD, DOE estimated the NPV of consumer benefits using both a 3-percent and a 7-percent real discount rate. DOE uses these discount rates in accordance with guidance provided by the Office of Management and Budget ("OMB") to Federal agencies on the development of regulatory analysis.[19] The discount rates for the determination of NPV are in contrast to the discount rates used in the LCC analysis, which are designed to reflect a consumer's perspective. The 7-percent real value is an estimate of the average before-tax rate of return to private capital in the U.S. economy. The 3-percent real value represents the "social rate of time preference," which is the rate at which society discounts future consumption flows to their present value.

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for GSFLs. It addresses the max tech levels examined by DOE and the projected impacts of these levels. Additional details regarding DOE's analyses are contained in the NOPD TSD supporting this document.

[19] United States Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. Section E. Available at *www.whitehouse.gov/omb/memoranda/m03-21.html* (last accessed March 4, 2022).

A. Economic Impacts on Individual Consumers

Based on the lack of energy savings and declining shipments of GSFLs, as discussed in sections IV.D and IV.F of this NOPD, DOE did not conduct LCC and PBP analyses to evaluate the economic impacts on individual consumers of amended GSFL energy conservation standards.

B. National Impact Analysis

This section presents DOE's estimates of the NES and the NPV of consumer benefits that would result from each of the ELs considered as potential amended standards.

1. Significance of Energy Savings

To estimate the energy savings attributable to potential amended standards for GSFLs, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under the max-tech levels for 4-foot T8 and 4-foot standard and high output T5 GSFL product classes. The savings are measured over the entire lifetime of products purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2026–2055).

The NIA model projected relatively low potential savings from a max-tech standard level and that the majority of savings realized by setting a GSFL standard are the result of incurring quicker market shift to LED alternatives, rather than the reduction in energy consumption of a constant GSFL market share. Further, because the entire tubular lamp market is projected to decline over the analysis period, most savings occur in the first decade of a potential standard. For more details, see chapters 9 and 10 of the NOPD TSD.

Table V.1 presents DOE's projections of the NES the max-tech levels considered for GSFLs. The savings were calculated using the approach described in section IV.G of this document.

Table V.1 Cumulative National Energy Savings for GSFLs (Quads); 9 Years of Shipments (2026–2034) and 30 Years of Shipments (2026–2055)

	Max Tech Savings	
	9 years shipments (2026 – 2034)	**30 years shipments (2026 – 2055)**
Site Energy	0.01	0.01
FFC Energy	0.03	0.03

OMB Circular A-4[20] requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A-4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this proposed determination, DOE undertook a sensitivity analysis using 9 years, rather than 30 years, of product shipments. The choice of a 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.[21] The review timeframe established in EPCA is generally not synchronized with the product lifetime, product manufacturing cycles, or

[20] U.S. Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. Available at *obamawhitehouse.archives.gov/omb/circulars_a004_a-4/* (last accessed March 4, 2022).

[21] Section 325(m) of EPCA requires DOE to review its standards at least once every 6 years, and requires, for certain products, a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. If DOE makes a determination that amended standards are not needed, it must conduct a subsequent review within three years following such a determination. As DOE is evaluating the need to amend the standards, the sensitivity analysis is based on the review timeframe associated with amended standards. While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6-year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some products, the compliance period is 5 years rather than 3 years.

other factors specific to GSFLs. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology. The NES sensitivity analysis results based on a 9-year analytical period are presented in Table V.1. The impacts are counted over the lifetime of GSFLs purchased in 2026–2034.

2. Net Present Value of Consumer Costs and Benefits

DOE estimated the cumulative NPV of the total costs and savings for consumers that would result from the max-tech levels considered for GSFLs. In accordance with OMB's guidelines on regulatory analysis,[22] DOE calculated NPV using both a 7-percent and a 3-percent real discount rate. Table V.2 shows the consumer NPV results with impacts counted over the lifetime of products purchased in 2026–2055.

Table V.2 Cumulative Net Present Value of Consumer Benefits for GSFLs (billions of 2021 USD); 9 Years of Shipments (2026–2034) and 30 Years of Shipments (2026–2055)

Discount Rate	Maximum Tech Standard	
	9 Years of Shipments (2026 – 2034)	30 Years of Shipments (2026 – 2055)
3 percent	0.21	0.26
7 percent	0.15	0.18

The NPV results based on the aforementioned 9-year analytical period are also presented in Table V.2. The impacts are counted over the lifetime of GSFLs purchased in 2026-2034. As mentioned previously, such results are presented for informational purposes only and are not indicative of any change in DOE's analytical methodology or decision criteria.

[22] U.S. Office of Management and Budget. *Circular A-4: Regulatory Analysis*. September 17, 2003. Available at *obamawhitehouse.archives.gov/omb/circulars_a004_a-4/* (last accessed March 4, 2022).

C. Proposed Determination

As required by EPCA, this NOPD analyzes whether the Secretary should issue a notification of determination not to amend standards for GSFLs based on DOE's consideration of whether amended standards would be technologically feasible, result in significant conservation of energy, and be cost effective. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)) Any new or amended standards issued by the Secretary would be required to comply with the economic justification and other requirements of 42 U.S.C. 6295(o).

1. Technological Feasibility

EPCA mandates that DOE consider whether amended energy conservation standards for GSFLs would be technologically feasible. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)(B)) DOE has tentatively determined that there are technology options that would improve the efficacy of GSFLs. These technology options are being used in commercially available GSFLs and therefore are technologically feasible. Hence, DOE has tentatively determined that amended energy conservation standards for GSFLs are technologically feasible.

2. Cost Effectiveness

EPCA requires DOE to consider whether energy conservation standards for GSFLs would be cost effective through an evaluation of the savings in operating costs throughout the estimated average life of the covered GSFLs compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered GSFLs which are likely to result from the imposition of an amended standard. (42 U.S.C. 6295(m)(1)(A), 42 U.S.C. 6295(n)(2)(C), and 42 U.S.C. 6295(o)(2)(B)(i)(II)) In the absence of a LCC analysis, DOE considers NPV estimated by the NIA model to estimate

the potential monetary benefits of amended standards for GSFLs. (*See* results in Table V.2) The inputs for determining the NPV are (1) total annual installed cost, (2) total annual operating costs (energy costs and repair and maintenance costs), and (3) a discount factor to calculate the present value of costs and savings. DOE observes that most of the estimated NPV resulting from a potential standard comes from operating cost savings associated to a slightly faster market transition to LED alternatives, rather than savings associated to lower energy consumption for GSFL consumers.

3. Significant Conservation of Energy

EPCA also mandates that DOE consider whether amended energy conservation standards for GSFLs would result in significant conservation of energy. (42 U.S.C. 6295(m)(1)(A) and 42 U.S.C. 6295(n)(2)(A)) DOE observed that a max-tech FFC energy savings of 0.03 quads over 30 years of shipments represents an approximately 1 percent decrease in total energy use of lamps shipped in the period 2026-2055. In addition, the model used to estimate these savings projects that most of this reduction comes in incurring a faster market shift to solid state lighting rather than a reduction in energy use among existing GSFL consumers.

DOE also notes that GSFLs are manufactured and sold at standard wattage levels, which restricts the effect of efficiency gains to increasing the amount of light provided by GSFLs rather than directly reducing energy consumption. For 4-foot T8 GSFLs, which represent the bulk of GSFL shipments, the same wattage options are available at the max tech standard level as at the baseline, so there is no reason to believe that GSFL consumers will use less energy as a result of a standard. The 0.02 FFC quads of potential energy savings associated with these lamps is thus uncertain, as consumers may simply continue to purchase a GSFL of the same wattage as their current lamp, rather than shift

to a lower wattage lamp or different lighting technology. Consumers who have not already transitioned to LED lighting, once the vast majority of the market has done so, may be less inclined to do so than the typical consumer modeled by the consumer-choice model.

The 8-foot recessed double-contact high-output product class and the 8-foot slimline product class do not include any lamp options at higher ELs that would reduce energy compared to the baseline lamp, with the exception of one lamp option in the 8-foot slimline product class that doesn't offer the same utility as the other representative lamp options because its lumen output is more than 10 percent lower. Thus there is no potential energy savings from more efficient GSFLs for the 8-foot product classes.

The potential FFC energy savings from the remaining (4-foot T5 standard and high output) product classes is only 0.01 quads over 30 years of shipments. While these product classes do offer a lower wattage option at max tech, in addition to an option with the same wattage as the baseline lamp, DOE notes that for standard output T5 lamps, the lower wattage lamp costs more than the baseline-equivalent wattage option, and for the high output T5 lamps, the lower wattage lamp costs similar to the baseline-equivalent option, again suggesting uncertainty that consumers will switch to a lower wattage lamp. Additionally, most potential energy savings would come from consumers switching to LEDs, and as with 4-foot T8 GSFLs, there is no guarantee that consumers will switch to LEDs as a result of a standard, rather than continue to purchase GSFLs of the same wattage as their current lamp.

Further, while consumers historically might save energy under a standard by retrofitting their systems with lower ballast factor ballasts to reduce the operating wattage

of their lamps (while retaining light output), it appears unlikely in the current market that consumers would retrofit their ballasts in this way as opposed to installing a solid-state lighting solution. This removes the potential lamp-and-ballast replacement approach as a strategy to save energy, and consequently this approach was not modeled in this analysis of potential energy savings.

4. Further Considerations

As discussed previously, any amended standards for GSFLs would be required to comply with the economic justification and other requirements of 42 U.S.C. 6295(o). Based on the: (1) uncertainty of potential energy savings discussed in detail in section V.C.3 of this document; (2) the fact that an amended standard for GSFLs would require manufacturers to invest in the manufacture of more efficient GSFLs at a time when the market is already rapidly declining, as discussed in section IV.F; and (3) international uncertainty regarding the ability to sell GSFLs in the future following the second segment of the fourth meeting of the Conference of the Parties to the Minamata Convention on Mercury,[23] DOE has tentatively determined that energy conservation standards for GSFLs would not be economically justified.

5. Summary

Based on the reasons stated in the foregoing discussion, DOE has tentatively determined that the energy conservation standards for GSFLs do not need to be amended because amended standards would not be economically justified.

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[23] clasp, "Convention on Mercury Promises CFLs Phase-Out; Action on LFLs Delayed," available at *https://www.clasp.ngo/updates/convention-on-mercury-agrees-to-phase-out-major-category-of-fluorescent-light-bulbs-but-last-minute-interventions-delay-action-on-another/*; UN Environment Programme, "Minamata COP-4 closes with global commitment to strengthen efforts against toxic mercury," available at *https://www.unep.org/news-and-stories/press-release/minamata-cop-4-closes-global-commitment-strengthen-efforts-against*; UN Environment Programme, "Minamata Convention on Mercury," available at *https://www.mercuryconvention.org/en*.

DOE will consider all comments received on this proposed determination in issuing any final determination.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866 and 13563

Executive Order ("E.O.") 12866, "Regulatory Planning and Review," as supplemented and reaffirmed by E.O. 13563, "Improving Regulation and Regulatory Review, 76 FR 3821 (Jan. 21, 2011), requires agencies, to the extent permitted by law, to (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public. DOE emphasizes as well that E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs ("OIRA") in the Office of Management and Budget ("OMB") has emphasized that such techniques may include identifying changing future compliance costs that might result from technological

innovation or anticipated behavioral changes. For the reasons stated in the preamble, this proposed regulatory action is consistent with these principles.

Section 6(a) of E.O. 12866 also requires agencies to submit "significant regulatory actions" to OIRA for review. OIRA has determined that this proposed regulatory action does not constitute a "significant regulatory action" under section 3(f) of E.O. 12866. Accordingly, this action was not submitted to OIRA for review under E.O. 12866.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis ("IRFA") for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by E.O. 13272, "Proper Consideration of Small Entities in Agency Rulemaking," 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website (www.*energy.gov/gc/office-general-counsel*).

DOE recently conducted a focused inquiry into small business manufacturers of the products covered by this rulemaking. DOE used the Small Business Administration ("SBA") size standards to determine whether any small entities would be subject to the requirements of the proposed determination. The small business size standards are listed by North American Industry Classification System ("NAICS") code as well as by

industry description and are available at *www.sba.gov/document/support--table-size-standards.* Manufacturing GSFLs is classified under NAICS code 335110, "electric lamp bulb and part manufacturing." The SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business for this category. DOE used the Compliance Certification Database[24] and other publicly available information to create a list of manufacturers. DOE then used market research tools to determine whether any of the potential manufacturers met the SBA's definition of a small entity, based on the total number of employees for each company including parent, subsidiary, and sister entities. DOE additionally screened out companies that are entirely or largely foreign owned and operated. DOE identified a total of 38 distinct potential small businesses that import or manufacturer GSFLs in the United States.

DOE reviewed this proposed determination under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. Because DOE is proposing not to amend standards for GSFLs, if adopted, the determination would not amend any energy conservation standards. On the basis of the foregoing, DOE certifies that the proposed determination, if adopted, would have no significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared an IRFA for this proposed determination. DOE will transmit this certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act

Manufacturers of GSFLs must certify to DOE that their products comply with any applicable energy conservation standards. To certify compliance, manufacturers must

[24] U.S. Department of Energy Compliance Certification Database, available at: *www.regulations.doe.gov/certification-data*.

first obtain test data for their products according to the DOE test procedures, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including microwave ovens. (*See generally* 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act ("PRA"). This requirement has been approved by OMB under OMB control number 1910-1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

DOE has tentatively determined that current standards for GSFLs do not need to be amended. This proposed determination, if made final, would not impact the reporting burden approved under OMB control number 1910-1400.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act of 1969

DOE is analyzing this proposed action in accordance with the National Environmental Policy Act of 1969 ("NEPA") and DOE's NEPA implementing regulations (10 CFR part 1021). DOE's regulations include a categorical exclusion for actions which are interpretations or rulings with respect to existing regulations. 10 CFR

part 1021, subpart D, appendix A4. DOE anticipates that this action qualifies for categorical exclusion A4 because it is an interpretation or ruling in regards to an existing regulation and otherwise meets the requirements for application of a categorical exclusion. *See* 10 CFR 1021.410. DOE will complete its NEPA review before issuing the final action.

E. Review Under Executive Order 13132

E.O. 13132, "Federalism," 64 FR 43255 (Aug. 10, 1999), imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed determination and has tentatively determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the GSFLs that are the subject of this proposed determination. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297) Therefore, no further action is required by E.O. 13132.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of E.O. 12988, "Civil Justice Reform," imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity, (2) write regulations to minimize litigation, (3) provide a clear legal standard for affected conduct rather than a general standard, and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding the review required by section 3(a), section 3(b) of E.O. 12988 specifically requires that executive agencies make every reasonable effort to ensure that the regulation: (1) clearly specifies the preemptive effect, if any, (2) clearly specifies any effect on existing Federal law or regulation, (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction, (4) specifies the retroactive effect, if any, (5) adequately defines key terms, and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this proposed determination meets the relevant standards of E.O. 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 ("UMRA") requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Pub. L. 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private

sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE's policy statement is also available at *www.energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf*.

DOE examined this proposed determination according to UMRA and its statement of policy and determined that the proposed determination does not contain a Federal intergovernmental mandate, nor is it expected to require expenditures of $100 million or more in any one year by State, local, and Tribal governments, in the aggregate, or by the private sector. As a result, the analytical requirements of UMRA do not apply.

H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105-277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This proposed determination, if finalized as proposed, would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

Pursuant to E.O. 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights," 53 FR 8859 (Mar. 15, 1988), DOE has determined that this proposed determination, if finalized as proposed, would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under the Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M-19-15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf*. DOE has reviewed this NOPD under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

E.O. 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to the Office of Information and Regulatory Affairs ("OIRA") at OMB, a Statement of Energy Effects for any proposed significant energy action. A

"significant energy action" is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor Executive Order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy, or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

This proposed determination, which does not propose to amend energy conservation standards for GSFLs, is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as such by the Administrator at OIRA. Accordingly, DOE has not prepared a Statement of Energy Effects.

L. Review Under the Information Quality Bulletin for Peer Review

On December 16, 2004, OMB, in consultation with the Office of Science and Technology Policy ("OSTP"), issued its Final Information Quality Bulletin for Peer Review ("the Bulletin"). 70 FR 2664 (Jan. 14, 2005). The Bulletin establishes that certain scientific information shall be peer reviewed by qualified specialists before it is disseminated by the Federal Government, including influential scientific information related to agency regulatory actions. The purpose of the bulletin is to enhance the quality and credibility of the Government's scientific information. Under the Bulletin, the energy conservation standards rulemaking analyses are "influential scientific information," which the Bulletin defines as "scientific information the agency reasonably

can determine will have, or does have, a clear and substantial impact on important public policies or private sector decisions." *Id.* at 70 FR 2667.

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and has prepared Peer Review report pertaining to the energy conservation standards rulemaking analyses.[25] Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. Because available data, models, and technological understanding have changed since 2007, DOE has engaged with the National Academy of Sciences to review DOE's analytical methodologies to ascertain whether modifications are needed to improve the Department's analyses. DOE is in the process of evaluating the resulting report.[26]

VII. Public Participation

DOE invites public participation in this process through participation in the webinar and submission of written comments and information. After the webinar and the closing of the comment period, DOE will consider all timely-submitted comments and additional information obtained from interested parties, as well as information obtained through further analyses.

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[25] "Energy Conservation Standards Rulemaking Peer Review Report." 2007. Available at *www.energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0* (last accessed March 4, 2022).

[26] The report is available at *www.nationalacademies.org/our-work/review-of-methods-for-setting-building-and-equipment-performance-standards*

A. Participation in the Webinar

The time and date of the webinar are listed in the **DATES** section at the beginning of this document. If no participants register for the webinar then it will be cancelled. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=22*. Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this NOPD, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may submit requests to speak to *ApplianceStandardsQuestions@ee.doe.gov*. Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this proposed determination and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

C. Conduct of the Webinar

DOE will designate a DOE official to preside at the webinar/public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the webinar/public

meeting. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the webinar/public meeting and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the proposed determination.

The webinar/public meeting will be conducted in an informal, conference style. DOE will present a general overview of the topics addressed in this rulemaking, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this proposed determination. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this proposed determination. The official conducting the webinar/public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the public meeting.

A transcript of the webinar/public meeting will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this NOPD. In addition, any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed determination no later than the date provided in the **DATES** section at the beginning of this NOPD. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this document.

Submitting comments via www.regulations.gov. The *www.regulations.gov* webpage will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment itself or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Otherwise, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information

(hereinafter referred to as Confidential Business Information ("CBI"). Comments submitted through *www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through *www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that *www.regulations.gov* provides after you have successfully uploaded your comment.

Submitting comments via email. Comments and documents submitted via email also will be posted to *www.regulations.gov*. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. With this instruction followed, the cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. No faxes will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, that are written in English, and that are free of any defects or viruses. Documents should not contain special characters or

any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: one copy of the document marked "confidential" including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

(1) DOE seeks comment on the technology options identified and the ones selected as design options in the screening analysis. See sections IV.B.2 and IV.B.3 of this document.

(2) DOE seeks comment on the performance characteristics of the more efficacious substitutes. See section IV.C of this document.

(3) DOE welcomes any relevant data and comment on the energy use analysis methodology. See section IV.D of this document.

(4) DOE welcomes any relevant data and comment on the shipments analysis methodology. See section IV.F of this document.

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notification of proposed determination and request for comment.

Signing Authority

This document of the Department of Energy was signed on May 23, 2022, by Kelly J. Speakes-Backman, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register,

the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on May 24, 2022

Treena V. Garrett
Federal Register Liaison Officer,
U.S. Department of Energy

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